

Fertiliser Management for Green Future: Catalyzing Farmers' Empowerment

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India is blessed with abundance of land, sun, water and human resources. Wide diversity of agro-climatic conditions makes it suitable for growth of variety of foodgrains and horticultural crops. The large populous country demands growth in agricultural productivity. The large section of society is still agrarian, which is helping to meet this objective. The growth of agriculture in India witness era of food scarcity in 1950s to self-sufficiency and now export potential country. The development of high yielding varieties of seeds led to growth in demand of nutrients required for higher production. Of the three primary nutrients, nitrogen (N) is abundant in atmosphere but present an inert form. Hence, it requires conversion to a compound, which can provide active nitrogen to the plant. Ammonia is the main source of N in fertilisers. However, hydrogen needed for production of ammonia is derived from hydrocarbon sources like natural gas. The availability of natural gas is limited in the country. Phosphate and potash are sourced from minerals. Mineral resources from which phosphate can be extracted are very low and resources for potassic minerals are negligible in India. Consequently, the challenge before the country to higher dependency on imports for raw materials, intermediates and finished fertiliser products. In view of this, it becomes prudent to use fertilisers judiciously and minimizing losses at every stage of supply chain from manufacturing/import to the application in the farms by the farmers. At the manufacturing stage, the production of fertilisers has achieved efficiency very close to the stoichiometric requirement of raw materials. A variety of slow release and alternative fertilisers have been developed, which coupled with modern agricultural practices have potential to increase

the nutrient use efficiency and substitute mineral fertilisers to some extent.

Policy of the government plays a great role in achieving the sustainability in fertiliser and agriculture sectors. The urea, which has substantial share in production, import and hence consumption, is regulated by fixing the retail price. The difference of cost of production and market retail price (MRP) is reimbursed as subsidy. The MRP has been at the same level for more than a decade, the cost of production has gone substantially high, thus, leading to significant increase in the share of subsidy. In the case of phosphatic and potassic fertilisers, subsidy is fixed based on nutrients in the products but MRP can be variable. For the last two years, due to geopolitical and demand-supply disruptions, the prices of P&K commodities have been quite volatile and risen significantly. To insulate farmers, the MRP of main product *viz.* DAP has been capped for the last two years, thus, resulting in higher subsidy outgo on this product.

The industry cooperates with the government to provide the fertilisers at the affordable prices. The government has also shown keen interest in revising the policies to capture the changed dynamics of fertiliser business. Both the fixed cost and energy consumption norms (a major element of cost) for urea plants under New Urea Policy (NUP) -2015 and Modified New Pricing Scheme (NPS) III are under revision. Energy consumption norms have been subjected to revision frequently but most of the elements of fixed cost were not updated since 2002-03. Fixed cost was revised on account of four major cost in 2008-09. The frequent revision of energy norms with consideration of capital expenses and non-revision of fixed cost for a long time, affecting the cash flows, surplus for re-investment in upkeep of the plants and servicing the debt. The industry has urged the government to provide cushion in both fixed cost and energy norms so that it can operate plant efficiently and sustain the production. In case of P&K fertilisers, industry may be allowed to operate as per the stated policy of the government of fixed subsidy and allowing manufactures to have arm length discovery of MRP and bring competitiveness and introduce new products.

Fertiliser production has increased manifolds over-past five decades. Fertiliser plants, in particular energy intensive urea production, have undertaken

Fertiliser management at every step of supply chain will play significant role in sustainable growth in farm productivity and help in achieving climate goals.

concerted efforts to decarbonise the sector. Energy efficiency in urea production has been improved by almost 37.4% in the past 36 years' period with corresponding reduction in carbon dioxide. Efforts made in this direction involve replacement of feedstock from naphtha and fuel oil to natural gas, revamp and retrofit, modernization/upgradation of old equipment and machineries, efficient utilization of waste heat, optimization of process parameters, etc. Process licensors are providing tailor-made strategies for older plants to improve efficiency. Original Equipment Manufacturers (OEMs) of rotating machines are working on to improve the efficiency of their machines. Further, integration of these machines in existing plants using renewable electricity and replacing steam, would be a promising area for decarbonization. As the steam and power operation are integrated for energy efficiency and varies widely, its implementation would require a detailed feasibility study.

Complex fertiliser units have achieved commendable levels of raw material efficiency by process optimization and improved scrubbing efficiency. The complex fertiliser plants depend on imported ammonia for production of fertilisers. The government initiative is to replace the import based grey with green ammonia. There is a mandate to replace about 0.726 million MT of ammonia every year starting from 2027-28. The green ammonia projects have challenges with respect to variability in availability of renewable energy and high cost. The technology suppliers are proposing green ammonia projects with optimizing capacity, intermittency of operation and viability by trading of renewable electricity. As ammonia is widely used chemicals, with over 80% consumption for production of fertilisers, worldwide. The transition strategy would be to produce low carbon ammonia producing using fossil fuels with high efficiency of carbon capture. These efforts would significantly help in reducing the sector's overall contribution to greenhouse gas (GHG) emissions.

Recognizing the importance of agriculture and role of fertilisers, government regulates the sectors all across the value chain. Government ensures that the agricultural inputs including fertiliser meet the quality standards, its availability during the sowing seasons is adequate and prices are affordable to the farmers. Fertiliser (Control) Order, 1985 have been enforced for quality and introduction of new fertiliser products including bio-fertilisers, organic, Nano-fertilisers and plant growth promoters in its ambit. Products are included after examining in-depth research, field trials and impact on environment by eminent bio-safety and bio-efficacy experts in their respective fields. Farmers are also being educated on sustainable practices of choosing right fertilisers, applying in required dosages at the right time. Use of modern technologies like drip irrigation for utilizing water soluble fertilisers and drones for application of Nano-fertilisers have immense potential to improve the efficiency of fertilisers. Digitalization can transform businesses to improve efficiency, decision-making, and customer experiences. Integration of e-commerce platforms and digital marketing channels can improve last-mile connectivity and engagement of the farmers. E-commerce is poised to play a pivotal role in modernizing fertiliser distribution system in the country.

Fertiliser industry has been continuously working to achieve high level of efficiency and reduce their GHG footprints. The application of fertilisers contributes to GHG emissions. Judicious application of fertilisers and adopting sustainable agriculture practices by farmers can help in reducing GHG emissions. Development of new products such as slow release, water soluble and customized fertilisers coupled with modern techniques are required to achieve the sustainable agriculture.

The FAI Seminar 2025 on the theme **Fertiliser Management For Green Future: Catalyzing Farmers' Empowerment** being organized during 10-12 December 2025 is focused to deliberate on all the issues needed for sustainable and green future in the agriculture sector. Policies and strategies for fertiliser sector are essential to align with this aim and help farmers to improve their social and financial status. ■